**BMC061. Voltage Controlled Multiplexer (MUX)**
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If you have any questions, or need help trouble shooting, please e-mail
Michael@Bartonmusicalcircuits.com

This module is a multiplexer designed to take up to eight input signals and select which is sent to the output.  It has two modes of operation, direct and rotating.

In direct mode, the output is selected by the summed voltage between the Select knob and Select control voltage, with the clock input timing when the changes happen.

In rotating mode, each tick of the clock input will cause the selected input to go up one step, the Select knob and CV control the highest numbered input it will rotate to before returning to the 1st input.

The module can multiplex input voltages with a range of -5V to +5V. .  The module should work without error with input clocks up to 50khz.

This module can be used with both +/-12V or +/-15V systems without any modifications. It requires no callibration.

## II. Schematic.
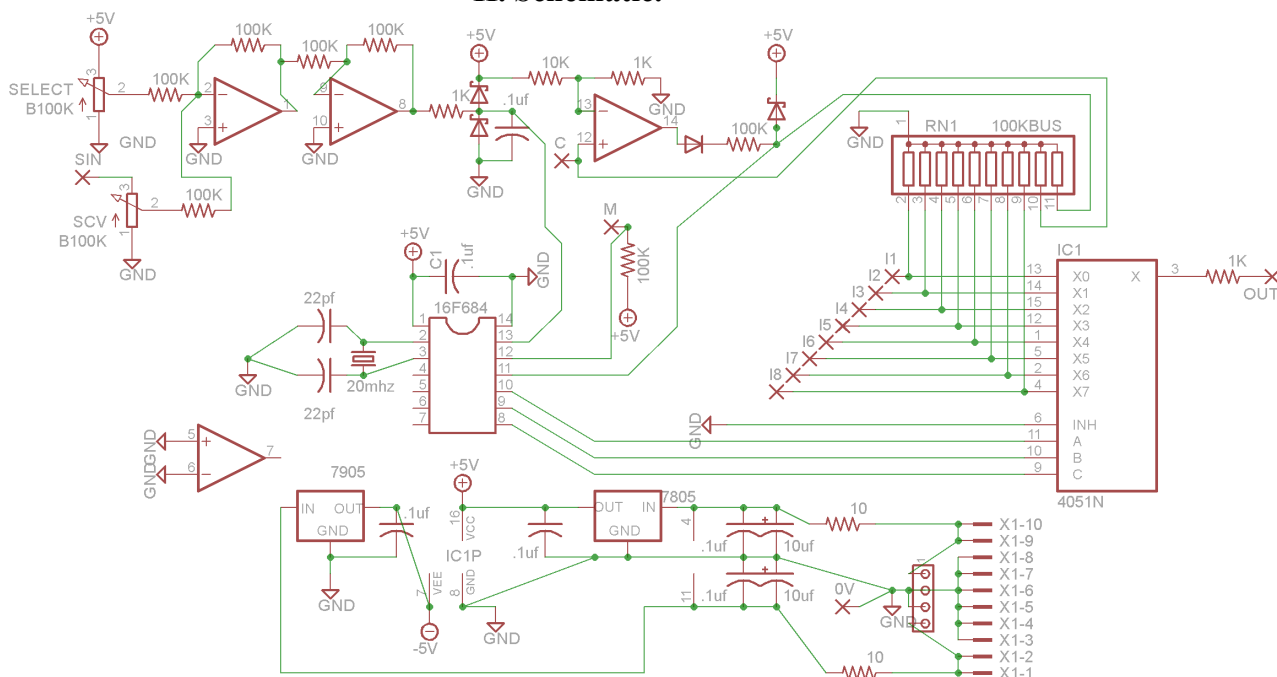


In the top of the module is the control circuitry.  Top left shows the Select pot and the Select CV input and pot.  Both pots are wired as variable attenuators with their wipers connected to 100K mixing resistors.  A pair of op-amps are wired as inverting amplifiers with a gain 1 to mix these voltages.  The output of the second amplifier connects to pin 13 of the PIC through a 1K resistor. Pin 13 also connects to a pair of schottky diodes connected to +5V and ground, these protect the PIC from overvoltage and undervoltage.  A .1uf capacitor connects pin 13 to ground in order to filter out high frequency noise and stabilize the voltage.

The clock wirepad marked "C" connects to another op-amp which is wired as a comparator. The positive input of the op-amp is also connected to 100K resistor to ground through the 100K resistor bus.  A 10K/1K resistor pair form a voltage divider which connects to the negative input of the op-amp to set the threshold for the comparator at .5V  The op-amps output goes through a switching diode to only allow positive voltages, then a voltage ladder formed by a pair of 100K resistors (the second of which is part of the resistor bus) and another schottky connected to +5V in order to protect pin 11 from overvoltages.

Pin 12 connects to the Mode toggle wirepad. A 100K resistor sets this pin to +5V unless the toggle connects to ground.  Pins 2 and 3 of the PIC connect to a 20mhz crystal oscillator which controls the clock speed of the microcontroller.  Pins 1 and 14 connect the PIC to the power supply.

Pins 8 – 11 are outputs that connect to the CD4051 CMOS multiplexer chip.  These pins

express the selected input for the mux in binary numbers.

The 4051 has eight input pins, each connected to a wirepad numbered "I1" through "I8." Each of these connects to the 100K resistor bus. The output goes through a 1K current limiting resistor.

At the bottom of the schematic are the power connections. Starting from the right we see the the connections for Eurorack and MOTM style power connectors set up in parallel. The positive and negative voltage rails are each filtered by passive lowpass filters formed from a 10ohm resistor and a 10uf capacitor. The TL074 is powered by these filtered voltages lines, as well as the positive power connection for the CD4051. At the power pins of each IC, there are .1uf capacitors to help keep the power supply clean (especially important when mixing analog and digital). The 7805 and 7905 voltage regulators provide +5V and -5V supplies. The +5V supply is used in powering the PIC while the -5Vsupply is connected to the negative pin of the 4051.

Unused input pins of the TL074 are grounded.

## III. Construction

### A.Parts List

**Semiconductors**

| Name | Quantity | Notes |
|---|---|---|
| PIC 16F684 | 1 | Provided with your PCB |
| CD4051 | 1 | 16 pin DIP package |
| TL074 | 1 | 14 pin DIP package |
| 7805 | 1 | TO-92 package |
| 7905 | 1 | TO-220 package |
| Switching diode | 1 | 1N4148 or similar |
| Schottky diode | 3 | Any small signal schottky |
| 20mhz Crystal | 1 | HC-49 Package |

**Resistors**

| Name/Value | Quantity | Notes |
|---|---|---|
| 10 ohm | 2 | 1/4w metal Film for all resistors unless otherwise noted |
| 1K ohm | 3 | |
| 10K ohm | 1 | |
| 100K ohm | 6 | |
| 100K bussed array | 1 | 11 pin SIP package. Or make your own from 10 resistors. |
| B100K potentiometer | 2 | 16mm with pins to solder to PCB. I use these. |

**Capacitors**

| Name/Value | Quantity | Notes |
|---|---|---|
| 22pf | 2 | Ceramic disc |
| .1uf | 6 | Ceramic disc. Value not critical |
| 10uf | 2 | Electrolytic, at least 16V rating. |

**Other**

| Name/Value | Quantity | Notes |
|---|---|---|
| Power connecter | 1 | Eurorack or MOTM |
| Toggle switch | 1 | SPDT. ON-ON  Like this. |
| Switching Jack | 11 | |
| 16 pin DIP socket | 1 | |
| 14 pin DIP socket | 2 | |

## B. The PCB

The PCBs dimensions are 62mm x 50mm. The pots are spaced 25.4 mm apart. Below are renderings of the PCB both with and without traces.

## C. Wiring
The PCB has thirteen wirepads. They should be connected as follows:

SIN – Select CV jack's tip

0V – Center lug of the Mode toggle AND to the sleeve of one of the jacks.

M – The top lug of the Mode select toggle

C – The tip of the clock input jack

OUT – The tip of the output jack

I1 – The tip of the Input 1 jack AND the switch of the clock input jack AND the switch of the input 2 jack.

I2 – the tip of the input 2 jack AND the switch of the input 3 jack.

I3 – the tip of the input 3 jack AND the switch of the input 4 jack.

I4 – the tip of the input 4 jack AND the switch of the input 5 jack.

I5 – the tip of the input 5 jack AND the switch of the input 6 jack.

I6 – the tip of the input 6 jack AND the switch of the input 7 jack.

I7 – the tip of the input 7 jack AND the switch of the input 8 jack.

I8 – the tip of the input 8 jack

Below is a picture of a wired module with the corresponding jacks labeled.